

CHAPTER 12

EL CENTRO FIELD OFFICE

ANALYSIS FOR PENDING LEASE

APPLICATIONS:

CACA 043965, CACA 046142

This Page Intentionally Left Blank

TABLE OF CONTENTS

Section	Page
12.1. INTRODUCTION	12-1
12.1.1 Introduction	12-1
12.1.2 Local Regulatory Considerations	12-1
California Desert Conservation Area Plan	12-1
State of California Renewable Portfolio Standard Program	12-2
State Implementation Plan for PM10 in the Imperial Valley, Executive Summary, Final (1993)	12-2
Imperial County General Plan (2003)	12-2
California State Protocol Regarding the Manner in which the BLM will Meet its Responsibilities under the National Historic Preservation Act and the National Protocol Agreement Among the BLM, Advisory Council on Historic Preservation, and National Conference of State Historic Preservation Officers (Rev. 2007)	12-3
12.1.3 Scope of Analysis and Approach	12-3
12.1.4 Cumulative Actions	12-4
12.2. PROPOSED ACTION AND ALTERNATIVES.....	12-5
12.2.1 Introduction	12-5
12.2.2 Proposed Action	12-5
CACA 046142	12-5
CACA 043965	12-8
12.2.3 Alternatives	12-9
Alternative A: No Action.....	12-9
Alternative B: Leasing with Stipulations.....	12-9
12.2.4 Reasonably Foreseeable Development Scenario.....	12-9
12.3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES	12-11
12.3.1 Introduction	12-11
12.3.2 Land Use and Recreation.....	12-11
Setting	12-11
Impacts	12-13
12.3.3 Geologic Resources and Seismicity	12-13
Setting	12-13
Impacts	12-14
12.3.4 Energy and Minerals	12-15
Setting	12-15
Impacts	12-16
12.3.5 Soil Resources	12-17

Setting.....	12-17
Impacts	12-17
12.3.6 Water Resources and Quality	12-18
Setting.....	12-18
Impacts	12-20
12.3.7 Air Quality and Atmospheric Values	12-21
Setting.....	12-21
Impacts	12-22
12.3.8 Vegetation.....	12-22
Setting.....	12-22
Impacts	12-25
12.3.9 Fish and Wildlife.....	12-27
Setting.....	12-27
Impacts	12-29
12.3.10 Threatened and Endangered Species and Special Status Species	12-30
Setting.....	12-30
Impacts	12-32
12.3.11 Cultural Resources.....	12-34
Setting.....	12-34
Impacts	12-38
12.3.12 Tribal Interests and Traditional Cultural Resources	12-39
Setting.....	12-39
Impacts	12-40
12.3.13 Visual Resources	12-42
Setting.....	12-42
Impacts	12-43
12.3.14 Socioeconomics and Environmental Justice	12-44
Setting.....	12-44
Impacts	12-46
12.3.15 Noise	12-46
Setting.....	12-46
Impacts	12-47
12.4. REFERENCES.....	12-49

FIGURES

Page

Figure 12-1 El Centro Lease Locations.....	12-6
--	------

TABLES	Page
Table 12.3-1 Species Known to Occur in the Pending Lease Area.....	12-31
Table 12.3-2 Recorded Cultural Resources in the Proposed Lease Areas	12-37
Table 12.3-3 Population by Race/Ethnicity in Imperial County	12-45

This Page Intentionally Left Blank

SECTION 12.1

INTRODUCTION

12.1.1 INTRODUCTION

This lease-specific analysis describes the environmental effects of leasing 3,322 acres of public land in two pending lease areas within the BLM El Centro FO to private industry for the development of geothermal resources. Within the El Centro FO management area, 118,720 acres of land are identified as having geothermal resource potential (Bureau of Land Management 1999). This acreage is divided into seven separate areas: Dunes, East Brawley, East Mesa, Glamis, Heber, Salton Sea, and South Brawley. The pending lease areas analyzed in this lease-specific analysis are within the Salton Sea resource potential area.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under BLM management policies and existing environmental regulations.

12.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Imperial County, California and are subject to state and local regulations, as described below.

California Desert Conservation Area Plan

The pending lease application sites are located within the California Desert Conservation Area (CDCA), which is managed under the CDCA Plan. Public lands within the CDCA have been classified into four multiple-use classes: C (controlled), L (limited use), M (moderate use), and I (intensive use). A fifth category of land is “Unclassified”, for parcels that are meant to be managed on a case-by-case basis. The plan includes a Geology-Energy-Minerals (G-E-M) resource element, which defines the following goals for G-E-M resources:

- I. Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.

2. Encourage the development of mineral resources in a manner which satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
3. Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

Specific objectives of the G-E-M element are:

1. To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for critical mineral resources, minerals of national defense importance, minerals of which the U.S. imports 50 percent or more, and minerals of which the U.S. is a net exporter.
2. To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for energy mineral resources. These are geothermal, oil, gas, uranium, and thorium, considered to be paramount priorities both nationally and within the State of California.

State of California Renewable Portfolio Standard Program

The California Renewable Portfolio Standard Program is a California law that requires investor-owned utilities to obtain 20 percent of the power supplied to customers to be generated from renewable resources by 2010. Geothermal energy is included in the definition of renewable resources under this program.

State Implementation Plan for PM₁₀ in the Imperial Valley, Executive Summary, Final (1993)

The pending lease application sites fall within the Salton Sea Air Basin, which is classified as a nonattainment area for inhalable particulate matter with a diameter less than 10 micrometers (PM₁₀), based on Federal Clean Air Act standards. This lease-specific analysis will consider the impact (if any) that geothermal leasing and any potential subsequent development would have on the State of California Air Quality Implementation Plan.

Imperial County General Plan (2003)

Growth within Imperial County is directed by the Imperial County General Plan. Geothermal energy development is addressed in one of the Plan's nine elements, *Geothermal and Transmission Element*. Imperial County has no direct land-use jurisdiction over public lands; therefore, neither the General Plan nor the Imperial County zoning regulations are directly applicable to activities proposed on public lands.

California State Protocol Regarding the Manner in which the BLM will Meet its Responsibilities under the National Historic Preservation Act and the National Protocol Agreement Among the BLM, Advisory Council on Historic Preservation, and National Conference of State Historic Preservation Officers (Rev. 2007)

The BLM has developed a National Protocol Agreement (PA) that governs the manner in which the BLM shall meet its responsibilities under the National Historic Preservation Act (NHPA). This revised State Protocol Agreement was developed pursuant to provisions of the National PA and revises the provisions of State PA between the California State Director of the BLM and the California State Historic Preservation Officer (SHPO), executed on October 25, 2004. This Protocol prescribes the manner in which the BLM and the SHPO cooperatively implement the National PA in California and in portions of Nevada managed by California BLM. It is intended to ensure that the BLM organizes its programs to operate efficiently and effectively in accordance with the intent and requirements of the NHPA and that the BLM integrates its historic preservation planning and management decisions with other policy and program requirements. The Protocol streamlines the NHPA Section 106 process by eliminating case-by-case consultation with the SHPO on undertakings that culminate in “no historic properties affected” (36 CFR 800.4(d)(1)) and “no adverse effect” findings (36 CFR 800.5(b)). The Protocol also requires development and management of a Historic Preservation Program (Section 110 of the NHPA) and implementation of the Program by each Field Office in partial exchange for relief from the case-by-case procedural requirements of 36 CFR 800.

12.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I. This lease-specific analysis examines the cluster of two pending lease application sites, describes the Reasonably Foreseeable Development scenario for this cluster, examines the existing environmental setting, and describes the potential direct, indirect, and cumulative impacts that issuing leases, and anticipated future actions following leasing, would have on the human and natural environment.

This report focuses on specific key resource concerns in the pending lease area, and incorporates by reference the impacts described in the PEIS. Decision-makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. El Centro FO staff members were contacted during the preparation of this lease-specific analysis to help identify local resource concerns.

12.1.4 CUMULATIVE ACTIONS

The El Centro FO was consulted to help identify projects in the vicinity of lease areas that may cumulatively impact resources in the area.

The FO currently has three pending right-of-way applications proposing projects on public lands in the general area of the geothermal lease applications between the Salton Sea and the Chocolate Mountains Gunnery Range. Two applications are for solar energy generation facilities:

- Right-of-way application CACA-49514 from SkyGen Solar for solar energy generation facilities, located at T9S, R13E, sections 26 and 34 (920 acres). The closest portion of these sections is approximately 3.2 miles west of Section 24 of pending lease application site CACA 046142.
- Right-of-way application CACA-48273 by BIO Renewable for solar energy generation facilities, located at T11S, R15E, Section 6 (640 acres). This location is approximately 2.8 miles southeast of sections 22 and 28 of pending lease application site CACA 043965.

The third right-of-way/temporary use permit application is related to Union Pacific Railroad's ongoing construction of a second track along their Sunset Route between El Paso, Texas, and Colton, California. The majority of the construction will be confined to their existing 200-foot railroad right-of-way, but there will be some expansion onto public land outside that boundary for culverts, drainages, berms, access, staging, etc.

No other anticipated projects were identified in the vicinity of the lease areas.

SECTION 12.2

PROPOSED ACTION AND ALTERNATIVES

12.2.1 INTRODUCTION

This chapter provides the details of the proposed action, alternatives to the proposed action, and an overview of the Reasonably Foreseeable Development scenario for pending lease application sites CACA 046142 and CACA 043965.

12.2.2 PROPOSED ACTION

The proposed action is for the BLM to issue the leases to the lease applicant for the two areas within the El Centro Field Office. The 3,321.9 acres of land are spread across a 16-mile area along the eastern side of the Salton Sea, in Imperial County, California (see Figure 12-1). Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.

The two pending lease sites are included within an area identified in the CDCA Plan as being the Salton Sea Known Geothermal Resources Area in the California Desert Conservation Area Plan (Bureau of Land Management 1999).

CACA 046142

CACA 046142 includes 2,161.90 acres of land within four parcels, as shown in Figure 1. The four parcels are comprised of all public lands contained within:

- Township 9 South, Range 12 East, Section 2;
- Township 9 South, Range 12 East, Section 12;
- Township 9 South, Range 12 East, Section 14, northwest quarter section, and the western half of the northeast quarter section; and
- Township 9 South, Range 12 East, Section 24.


CACA 046142 lands are located 2.5 to 5.5 miles northeast of the community of Bombay Beach, largely north of Highway 111, with a portion of Section 24 located south of the highway.



C:\EMPS\Geothermal\PEIS\Figures

Both lease sites are on BLM lands.

LEGEND:

 Lease site boundary

El Centro Lease Locations

CACA 043965, 046142

El Centro FO

Figure 12-1

The Section 2 parcel contains a plot of land 0.66 miles long in the east-west orientation, and from 0.25 to 0.35 miles long in the north-south orientation. The parcel is completely undeveloped and ranges in elevation from 130 feet below mean sea level to 90 feet below mean sea level. The site slopes down gently to the southwest, and features two intermittent streams and a wetland. The eastern boundary of the site is defined by Hot Mineral Spa Road. Five hot springs are recorded immediately east of the site. Some of these hot springs are used for aquaculture by Pacific Aqua Farms (U.S. Marine Shrimp Farming Program 2008; Oregon Institute of Technology 2008).

In addition to Pacific Aqua Farms, two other geothermal operators are listed at nearby addresses on Hot Mineral Spa Road: Fred F. Bartlett and Oscar Bashford (Division of Oil, Gas, and Geothermal Resources 2005).

The Section 12 parcel contains a plot of land measuring one mile by one mile. The parcel is the entire Section 12, minus two eighth-sections. The parcel is completely undeveloped and ranges in elevation from 140 feet below mean sea level to 50 feet below mean sea level. The site slopes down gently to the southwest, and features four intermittent streams and at least one wetland—the USGS topographic map indicates the presence of extensive wetland on the site; however, the Fish and Wildlife Service wetland mapper indicates only a small isolated wetland. A mobile home park is located directly to the east of the southern part of Section 12. The site is bound by Hot Mineral Spa Road to the west and Mineral Road to the east. Coachella Canal Road crosses both northeast corners of the site. A mobile home community is located directly east of the southern portion of the site.

The Section 14 parcel contains a rectangular plot of land measuring 0.75 mile in the east-west direction by 0.50 mile in the north-south direction. The parcel is completely undeveloped and ranges in elevation from 180 feet below mean sea level to 150 feet below mean sea level. The site slopes down gently to the southwest, and features five intermittent streams. The closest road access to the site is from Hot Mineral Spa Road, which is approximately 230 yards from the southeastern corner of the parcel. There are no developed uses adjacent to the parcel.

The Section 24 parcel contains a one mile by one mile section of public land. The parcel is largely undeveloped except for being crossed by a highway, a railroad, and a transmission line. The site ranges from 200 feet below mean sea level to 150 feet below mean sea level. The site slopes down gently to the southwest, and features two intermittent streams. Highway 111 crosses the southeastern third of the parcel on a northwestern-southeastern direction. There are no developed uses adjacent to the parcel.

CACA 043965

CACA 043965 includes 1,160.0 acres of land within three parcels, as shown in Figure 12-1. The three parcels are comprised of all public lands contained within:

- Township 10 South, Range 14 East, Section 8;
- Township 10 South, Range 14 East, Section 22; and
- Township 10 South, Range 14 East, Section 28, northeast quarter of the southeast quarter section.

CACA 043965 lands are located 2.5 to 6 miles north of the community of Niland, and east of Highway 111.

The Section 8 parcel is an irregularly shaped plot of land measuring between 0.5 and 1 mile in the east-west direction and between 0.5 and 1 mile in the north-south direction. The parcel is completely undeveloped and ranges in elevation from 40 feet below mean sea level to 80 feet above mean sea level. The southwestern portion of the site slopes down gently to the southwest, and the north eastern portion of the site slopes in the same direction but much more steeply and with uneven topography. Two intermittent streams cross the site. Old Niland Road/English Road forms the western boundary of the site, and Coachella Canal Road runs along the site approximately 135 yards to the northeast. The only developed land use adjacent to the site is agriculture immediately to the south.

The Section 22 parcel is an irregularly shaped plot of land measuring between 0.5 and 1 mile in the east-west direction and between 0.5 and 1 mile in the north-south direction. The parcel is completely undeveloped and ranges in elevation from zero feet above mean sea level to 80 feet above mean sea level. The site slopes down gently to the southwest with some variations in topography including the shoreline of the ancient Lake Cahuilla that exists as a distinct linear drop in elevation that crosses the southwestern portion of the site. Associated with the ancient shoreline is an ancient beach from that shoreline, noted on the USGS topographic quadrangle map as “Old Beach”. A wash crosses the northern portion of the site in the northeastern-southwestern direction, transitioning into an intermittent creek that leaves the western boundary of the site. The eastern portion of the site is crossed by Gas Line Road, which runs in a north-south direction. There are no developed land uses directly adjacent to the site.

The Section 28 parcel is a square-shaped plot of land measuring 0.25 mile by 0.25 mile. The parcel is undeveloped except for Wilkins Road and the Imperial Irrigation District East Highline Canal, which both cross the southwestern portion. The site ranges in elevation from 60 feet below mean sea level to 30 feet below mean sea level. The site slopes down gently to the southwest. The

only developed land use adjacent to the site is agriculture immediately to the north.

12.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, Proposed Action.

Alternative A: No Action

Under Alternative A, the BLM would deny the two pending lease applications.

Alternative B: Leasing with Stipulations

Under Alternative B, the BLM would issue the leases with the stipulations identified in Chapter 2 of the PEIS.

12.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

It is expected that each of the pending lease sites could support a binary powerplant with a 50 megawatts of capacity; therefore, the Reasonably Foreseeable Development scenario for this lease-specific analysis is two binary powerplants with a combined capacity of 100 megawatts. It is expected that each of the lease sites could support a binary powerplant with a 50 megawatts of capacity; therefore, the Reasonably Foreseeable Development scenario for this lease-specific analysis is two binary powerplants with a combined capacity of 100 megawatts. Each of the power plants would be expected to result in 25 acres of disturbance for a total disturbance of 50 acres.

Exploration activities for the two 50 megawatt plants is expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 2 acres. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that commercially viable resources are found within both lease areas, drilling operations and development of the site would be expected to result in a further approximately 16 acres of land disturbance (roughly 8 acres within each lease site) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately 32 acres of land disturbance (roughly 16 acres at each lease site) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would be graded and vegetated to pre-disturbance conditions, as described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

SECTION 12.3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

12.3.1 INTRODUCTION

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: wild horses and burros, livestock grazing, wilderness, National Scenic and Historic Trails, and special designations.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outlined in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

12.3.2 LAND USE AND RECREATION

Setting

This section is a discussion of the current land ownership and use within the Region of Influence (ROI) for the two pending lease sites that are part of the proposed action. The ROI is the land area within and adjacent to the potential lease sites.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal

lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the BLM. The CDCA Plan also addresses energy development on public lands within the California Desert Conservation Area under its G-E-M elements, as detailed in Chapter I.

The Imperial County General Plan guides development on private lands surrounding proposed lease areas. Energy production is considered a permitted use in open space and public areas under a special use permit. The general plan specifically recognizes and encourages further use and development of geothermal resources in the Salton Sea area.

Regional Setting

The geothermal pending lease areas are located on the east side of the Salton Sea, along the western foothills of the Chocolate Mountains in Imperial County. The total pending lease area covers approximately 3,321.9 acres. Lands within and adjacent to potential lease areas are owned or administered by a variety of entities, including the BLM. Public lands are administered for multiple uses including mining, livestock grazing, recreation, energy, and utility development as well as conservation of desert resources.

Adjacent land ownership is a mix of public and privately owned lands. Adjacent land contains both land developed for agricultural purposes and undeveloped areas. Additional uses are described for the areas adjacent to each pending lease site below. The nearest population centers are Bombay Beach, 2.5 to 5.5 miles southeast of CACA 046142, and Niland, 2.5 to 6 miles south of CACA 043965. Dispersed recreational use may occur throughout the pending lease areas (e.g. OHV use, hunting, hiking, mountain biking, etc.).

Pending Lease Areas

The CDCA classifies the lease sites as “Unclassified”. These lands have not been placed within multiple-use classes and are intended to be managed on a case-by-case basis.

CACA 046142

CACA 046142 is completely undeveloped except for a highway, a railroad, and a transmission line which cross through Section 28. Adjacent land uses are largely undeveloped, except for a mobile home park and an unidentified industrial or commercial complex utilizing local hot springs east of Section 2 and north of Section 12.

CACA 043965

CACA 043965 is undeveloped except for a road and a canal that cross through Section 28. Adjacent lands are a mix of undeveloped and agricultural uses.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on land use and recreation because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not cause any direct impacts on land use or recreation; however, the anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. According to the Reasonably Foreseeable Development scenario, one plant will be developed at each pending lease site for a total of 2 power plants with 100 megawatts capacity. General impacts on land use associated with a typical 50 megawatts plant are discussed in *Section 4.2. Land use, Recreation, and Special Designations* of Volume I of the PEIS. Specific to the lease area, geothermal development could impact the local mobile home park by providing an additional source of electricity for the residents if development is successful.

The Proposed Action would be consistent with the Imperial County General Plan, as well as with the CDCA Plan.

Cumulative Impacts

The proposed plant site, associated wells, pipelines, and transmission lines would not conflict with any land use designations under the Imperial County General Plan, or under the CDCA Plan. All identified cumulative actions, including the Proposed Action would comply with local land use regulations.

Cumulative impacts on recreation from the proposed action and other local development involve possible access limitations to recreation areas, scaring wildlife away, and reducing overall recreational enjoyment, such as diminishing the visual qualities of recreation areas/adjacent land.

I2.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The pending lease sites lie within the Imperial Valley portion of the Salton Trough, which encompasses the Coachella, Imperial and Mexicali valleys and extends north from the Gulf of California. The part of the trough with the lowest elevation is inundated by the Salton Sea, which has a water surface level of approximately 227 feet below mean sea level. Geologically, the structure of the trough is a result of an evolving "rift" in the earth's crust due to tectonic plate movement. The trough represents an area of "spreading", where two plates are moving away from one another. The meeting of the two plates is at the San Andreas Fault, which runs up the center of the trough through the center of the Salton Sea. This spreading brings magma closer to the surface, heating deep groundwater and resulting in the abundant geothermal resources

in the area. Nonmarine and alluvium sediments cover large portions of the trough. An unexposed succession of Tertiary- and Quaternary-age sedimentary rocks lies below the alluvial and lake bottom sediments, ranging in depth from 11,000 or greater feet at the margins to more than 20,000 feet in the central portions of the Salton Trough. Basement rock consisting of Mesozoic granite and probably Paleozoic metamorphic rocks are estimated to exist at depths between 15,000-20,000 feet. The valley is drained by an 8,360 square mile watershed, which eventually empties into the Salton Sea (City of El Centro 2004).

The pending lease sites are located along the eastern edge of the Imperial Valley, spread across a range of elevations from 200 feet below mean sea level to 80 feet above mean sea level. The shoreline of the ancient Lake Cahuilla lies at approximately 40 feet above mean sea level. Most of the pending lease areas lie below this line, in the ancient lake bed, with a small portion of the sites lying above the line, in the foothills of the Chocolate Mountains.

Due to the “spreading” discussed above, and the presence of the San Andreas Fault, the Imperial Valley is one of the most seismically active regions in the United States. Branches of the San Andreas Fault form the eastern boundary of the basin (Salton Trough). More small to moderate earthquakes have occurred in the Imperial Valley area than along any other section of the San Andreas Fault System. During the 20th Century, the Imperial Valley experienced eleven earthquakes of magnitude 6.0 or greater on the Richter Scale with the strongest being a magnitude 7.1 temblor on the Imperial Fault in 1940. The deep, sediment-filled geology of the Trough makes the area particularly susceptible to severe earthquake damage through ground shaking, liquefaction, and landslides (City of El Centro 2004).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on geologic resources because no ground-disturbing activities would be approved, and would not put any people or structures at risk from seismic-related events.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, the geothermal development activities likely to follow leasing would potentially result in impacts related to inducing seismic events and putting people and structures at risk from seismic events.

The composition of geologic strata (bedrock and soil) determines what can be expected from an area as a result of ground shaking. The portions of the pending lease sites below the ancient shoreline of Lake Cahuilla would be more susceptible to ground shaking and liquefaction due to the large amounts of

sediment-based geology in the area. Slopes are generally not steep below the ancient shoreline, and landslides and bluff failures are generally not a concern. Bluff failures and mudslides do have the potential to occur along the embankments of intermittent streams and washes. Above the ancient shoreline, topography is steeper and uneven, making this area more susceptible to landslides and bluff failures.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction can withstand strong seismic events, and that facilities would be placed within safe distances from potential landslide and bluff failure areas.

Subsidence can occur where groundwater is pumped from underground aquifers at a rate exceeding the rate that it is of replenished. Most of the geothermal development includes reinjection of the geothermal fluid after the heat is utilized. Therefore, the potential for subsidence is low.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on geologic resources and seismicity in the lease area. The cumulative effects of anticipated future actions following leasing on geologic resources and seismicity are expected to be generally minor provided that construction and operation of the proposed geothermal plants are in compliance with building codes, and state and local permit requirements.

12.3.4 ENERGY AND MINERALS

Setting

IID Energy is the local utility company providing electricity in the Imperial Valley. IID Energy provides electric power to over 140,000 customers in the Imperial Valley and parts of Riverside and San Diego counties. IID Energy controls more than 1,100 megawatts of energy derived from a diverse resource portfolio that includes its own generation, and long- and short-term power purchases (IID Energy 2008). IID Energy's service area is experiencing a seven percent annual growth rate (IID Energy 2006).

IID is a participant in the Green Path Project; a first of its kind public-private venture between IID, Citizens Energy, and the Los Angeles Department of Water and Power. The project in part seeks to find a long-term solution to reduce California dependence on imported fuel, and works toward this by creating a transmission corridor to transport renewable resources, such as geothermal, solar, and wind energy, from the Imperial Valley to the load centers throughout California (IID Energy 2006).

IID has adopted the State of California Renewable Portfolio Standard (RPS). IID's RPS aims to procure electricity from eligible renewable resources to maintain a portfolio level of a minimum 20% by 2017, consistent with the provisions of Senate Bill 1078 (IID Energy 2006).

Imperial County contains one of the potentially largest liquid-dominated geothermal resources in the world (Lawrence Berkeley National Laboratory 1997). The geothermal resources in the County are the hottest and located at relatively shallow depths. Imperial County is a national leader in the development of its geothermal resources, but development has slowed compared to earlier County projections due to high operating costs, slow growth in utility company demand, and relatively low oil prices. The County supports and encourages the development of geothermal resources in a manner compatible with the protection of agricultural and environmental resources (Imperial County 2003).

About 60 types of minerals are extracted in Imperial County, with production being focused on gold, gypsum, sand, clay and stone. Other minerals of note are manganese, silver, copper, arsenic oxide claudetite, blodite, and kyanite. Mining has generally been limited to the southern Chocolate Mountains and the Cargo Muchacho Mountains (California Division of Mines and Geology 1966), both of which are in southeastern Imperial County, at least 30 miles from the pending lease areas. Mining in the Imperial Valley is largely limited to water availability, the presence of Native American resources, special status species habitat, and other resources protected by the CDCA Plan.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, the geothermal development activities likely to follow leasing would likely result in the use of a currently unused geothermal resource and would contribute a renewable form of energy to the power grid. According to the Reasonably Foreseeable Development scenario, development of one geothermal power plant of 50 megawatts at each pending lease area for a total of 10 megawatts is likely. Impacts for a typical 50-megawatt plant are discussed in Chapter 4 of Volume I of the PEIS, *Energy and Minerals*.

Anticipated future actions following leasing could potentially contribute to local and State efforts to meet the RPS as detailed under Senate Bill 1078.

Development could prevent other energy sources from being developed or minerals from being extracted in the immediate lease area.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on energy and minerals; however, the geothermal development activities likely to follow leasing could contribute to cumulative energy and mineral impacts in the Southwest. Development of the lease sites in combination with other geothermal energy projects in the region would cumulatively improve the regionally and locally generated renewable electricity supply.

12.3.5 SOIL RESOURCES**Setting**

The Natural Resources Conservation Service does not include data for soil resources in CACA 046142 on their Web Soil Survey application, but are expected to be similar to the soil resources found below the shoreline of ancient Lake Cahuilla in CACA 043965 (described below).

Soils in CACA 043965 below the shoreline of the ancient Lake Cahuilla are generally of the Niland Series, an alluvial soil series. The Niland series is a member of the sandy over clayey, mixed (calcareous), hyperthermic family of Typic Torrifluvents. Typically, Niland soils have very pale brown, stratified, gravelly sand and sand overlying pale brown, silty clay at a depth of 23 inches. They are nearly level and on basin and floodplain edges at elevations of 300 to minus 235 feet. Niland series soils formed in coarse mixed alluvium overlying fine alluvium at depths of less than 36 inches. Slopes of this soil type are usually less than 1 percent but range up to 5 percent. The soils are well and moderately-well drained with slow runoff. Permeability of the sandy portion is rapid and permeability of the clayey portion is slow. Niland soils are used for growing irrigated row crops, field crops, and winter vegetables. Native vegetation is a sparse growth of creosotebush and wingscale. Mesquite and salt cedar grow in these soils where they can reach ground water (Natural Resources Conservation Service 2003).

Limited soil resource data is available for the portions of the pending lease areas above the shoreline of the ancient Lake Cahuilla. The Natural Resources Conservation Service online web soil survey classifies these areas largely as “badlands”. Badlands are generally defined as having very irregular topography resulting from wind and water erosion of sedimentary rock.

Impacts**Alternative A (No Action)**

The No Action alternative would have no impact on soil resources because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated ground disturbance from the geothermal exploration and development activities likely to follow leasing would potentially result in impacts on erosion and soil productivity.

Overall, impacts on soil resources would be similar to impacts identified in Chapter 4 of Volume I of the PEIS for the four phases of development. Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils, and that erosion-prevention measures be implemented in accordance with permitting requirements. Any disturbance of greater than one acre would require a General Construction Stormwater Permit from the State Water Resources Control Board, and as part of that permit application, a Stormwater Pollution Prevention Plan would be submitted. The Plan would describe erosion-prevention measures that would be incorporated into project plans.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on soils in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative soil impacts such as erosion and compaction. These impacts are expected to be generally minor provided that construction and operation of the proposed geothermal plants and other local developments are in compliance with building codes, and state and local permit requirements.

12.3.6 WATER RESOURCES AND QUALITY**Setting*****Surface Water***

Both pending lease areas are in the Imperial Hydrologic Unit. Annual average precipitation is about 2.5 inches (Colorado River Regional Water Quality Control Board 1986). Surface drainage is southeastward to the Salton Sea via a series of intermittent creeks and washes. Colorado River water, imported via the All American Canal, is the predominant water supply for the region and is used for irrigation, industrial, and domestic purposes (Colorado River Regional Water Quality Control Board 2006).

From a quantity standpoint, agricultural use is the predominant beneficial use of water in the Colorado River Basin Region, with the major irrigated acreage being located in the Coachella, Imperial and Palo Verde Valleys. The use of water for municipal and industrial purposes, which is second in quantity of usage, is also located largely in these valleys and in the Joshua Tree and Dale Hydrologic Units of the Lucerne Valley Planning Area. The third major category of beneficial use, recreational use of surface waters, represents another

important segment of the Region's economy (Colorado River Regional Water Quality Control Board 2006).

Ground Water

In Imperial Valley, ground water is stored in the Pleistocene sediments of the valley floor, the mesas on the west, and the East Mesa and sand hills on the east. The fine-grained lake sediments in the central portion of Imperial Valley inhibit ground water movement. Few wells have been drilled in these lake sediments because the yield is poor and the water is generally saline. The few wells in the Valley are for domestic use only. Factors that diminish ground water reserves are consumptive use, evapotranspiration, evaporation from soils where ground water is near the surface, and losses through outflow and export (Colorado River Regional Water Quality Control Board 2006).

The Colorado River Regional Water Quality Control Board defines the pending lease areas as being within the Imperial Hydrologic Unit are listed Beneficial uses for groundwater in the project area are described in the Water Quality Control Plan as being "Municipal and Domestic Supply" and "Industrial Service Supply". Industrial and Service Supply is defined as "*Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization*". Municipal and Domestic Supply is defined as "*Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply*" (Colorado River Regional Water Quality Control Board 2006).

Both pending lease areas are within the East Salton Sea Groundwater Basin, which is a sub-basin of the Imperial Hydrologic Unit. This basin underlies Chocolate Valley in southern Riverside County and northern Imperial County. The basin is bounded by nonwater-bearing rocks of the Chocolate Mountains on the north and east and by the San Andreas and Banning Mission Creek faults on the west. The Chocolate Valley is drained by the Iris and Mammoth Washes to the Salton Sea (California Department of Water Resources 2003).

Water level measurements made between 1963 and 2000 indicate a steady decline has occurred in the basin over that period. Groundwater levels range from 20 to 48 feet below the surface. Groundwater moves in a southwest direction as underflow to the Salton Sea. Total storage capacity is estimated to be 360,000 acre-feet, and natural recharge is estimated at about 200 acre-feet per year. Extractions totaled about six acre-feet in 1952. Groundwater in the basin is sodium chloride or sodium sulfate in character, with TDS content ranging from 356 mg/L to 51,632 mg/L. Groundwater in the basin is not suitable for domestic, municipal, or agricultural purposes (California Department of Water Resources 2003).

Water Supply

Water in the Imperial Valley is managed by the Imperial Irrigation District (IID) Water Department. IID facilitates the transfer of raw Colorado River water for agricultural, as well as industrial, rural-residential and municipal non-potable use in the Imperial Valley. As throughout the Southwestern United States, water rights in the Imperial Valley are complex and controversial. Under legal agreements, IID exports water to the Metropolitan Water District of Southern California and the San Diego County Water Authority. As the water needs of Southern California have increased, so have the volumes of water that IID have been required to export. To offset these losses to the Imperial Valley, IID has implemented an aggressive water conservation plan involving increasing the efficiency of irrigation practices and fallowing of agricultural fields.

Impacts**Alternative A (No Action)**

The No Action alternative would have no impact on water resources and quality because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on water quality; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts on water quality. Overall, impacts on water resources and water quality would be similar to impacts identified in Chapter 4 of Volume I of the PEIS for the four phases of development. Indirect use geothermal projects require large amounts of water during all phases of a project from exploration through reclamation and abandonment; therefore, anticipated future actions following leasing under the Proposed Action could result in impacts on the local water supply. Either groundwater or surface waters (IID waters, agricultural waste waters, Salton Sea waters) may be sought after for project-related water needs.

The project would not interfere with the designated groundwater beneficial use of *Municipal and Domestic Supply* since it is identified as being unsuitable for such purposes. The proposed action would be consistent with the other designated groundwater beneficial use of *Industrial and Service Supply*.

Developing the geothermal resource at CACA 046142 could impact the local hot springs if the geothermal reservoir is connected to the water table aquifer. The potential for these types of adverse impacts is reduced through extensive aquifer testing, which is the basis for designing the geothermal plant and for locating, designing, and operating the extraction and injection wells. Combined with the requirement to comply with state and federal regulations that protect water quality and with limitations imposed by water rights issued by the state engineer, the impacts on water quality and the potential for depleting water resources is expected to be minimized.

Any future development of the lease sites would not interfere with the existing beneficial uses of surface water in the Colorado River Basin Region since one of those identified uses is “Industrial”. The availability of sufficient surface water to support an individual project would need to be confirmed with the Imperial Irrigation District.

The high volumes of water required for geothermal power plants may pose water acquisition challenges given the supply issues in the Imperial Valley.

Mitigation

Prior to development an assessment of a particular project’s estimated impact on the local groundwater basin would need to be conducted.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on water quality or quantity in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative water quality and quantity impacts in the area. Geothermal development, as with the identified potential solar energy projects and railroad work, could impact surface water quality through ground disturbance and stormwater runoff. Groundwater quality could be cumulatively impacted through onsite spills of petroleum products and other chemicals used during construction and maintenance of facilities. Lease stipulations identified in Chapter 2 and best management practices in Appendix D of the PEIS would reduce these potential cumulative impacts.

The identified potential solar energy projects and railroad work would not have the potential to require groundwater usage, so no cumulative impacts on groundwater supply would be expected. All construction projects require the use of water for dust abatement. All identified projects would require water to be brought onsite with watering trucks. Construction-related water needs would be temporary.

Ongoing use of water for geothermal power plant operation would have cumulative impacts on regional water supply.

I2.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The lease area lies within the Imperial Valley, which is part of the Great Basin. The Great Basin extends from Utah to the Sierra Nevada and has no surface drainage to the ocean. It is an area of climatological extremes, with the lease area being within one of the hottest and driest parts of the State. The principal climatic features of the lease area are bright sunshine, small annual precipitation, (averaging less than three inches per year), clean, dry air, and exceptionally large

daily ranges of temperature. The closest weather monitoring station to the lease site with comprehensive historical data is in Brawley. Average maximum temperatures in Brawley range from 69.5 degrees Fahrenheit in January, to 107.8 in July, with average minimum temperatures ranging from 39.3 degrees Fahrenheit in January, to 76.0 in August (Western Regional Climate Center 2007).

Imperial County is in Federal Nonattainment for PM_{10} and ozone is in Attainment for all other criteria pollutants.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality and local climate because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on air quality or atmospheric values; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Geothermal exploration and development activities would potentially result in impacts on criteria pollutant levels, including PM_{10} and ozone, as described in the PEIS. General impacts from the four phases of geothermal development are identified in Chapter 4 of the PEIS.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on air quality in the Imperial Valley; however, anticipated geothermal exploration and development activities likely to follow leasing could contribute to cumulative air quality impacts. Construction-related dust and diesel exhaust would be realized from the exploration and drilling operations and development phases of geothermal development, as well as all from other identified cumulative actions. These cumulative impacts would be temporary.

Cumulative air quality impacts during the utilization phase of a geothermal project would be limited to vehicle travel of operation and maintenance staff. Emissions from these vehicles would cumulatively contribute to a degradation in air quality along with similar vehicular exhaust associated with operation and maintenance of the potential solar energy facilities.

12.3.8 VEGETATION

Setting

The entire Salton Sea area is very dry and hot, and vegetation occurring is well adapted to these extreme conditions. The vegetation is sparse, but plays a critical role in ecosystem function, providing cover for wildlife from the sun and

predators. The pending lease areas are located within the Imperial Valley subsection of the Colorado Desert ecoregion section (US Forest Service 2008). This subsection surrounds the western and southern sides of the Salton Sea and extends south past the Mexico border. Average annual temperatures range from 70 degrees Fahrenheit (°F) in January to 107 °F in July. Precipitation comes only in the form of rain and three to six inches fall annually in the area (Western Regional Climate Center 2007).

The majority of the lease area is sparsely vegetated. Gravel and larger stones make up the surface substrate in many places. Where vegetation is present the predominant natural plant communities found in the pending lease areas are the Creosote bush scrub, Allscale, Iodine Bush, Saltbush, and Agricultural/ruderal communities.

Creosote Bush Scrub

Creosote bush scrub is common in the pending lease areas (US Forest Service 2008). This plant community typically occurs on well-drained secondary soils of slopes, fans, and valleys. This habitat type is generally characterized by relatively barren ground with wide-spaced shrubs. Common plants include pure stands of creosote bush (*Larrea tridentate*) or mixed shrubs, including species of burrobush/white bursage (*Ambrosia dumosa*), brittlebush (*Encelia farinosa*), ocotillo (*Fouquieria splendens*), and saltbushes (*Atriplex*) (Sawyer and Keeler-Wolf 1995). Less abundant species may include desert-holly (*Atriplex hymenelytra*), ephedras (*Ephedra* species), box-thorns (*Lycium* species), prickly-pears (*Opuntia* species), and indigo bush (*Psoralea schottii*).

Allscale

The allscale plant community is often considered part of the saltbush scrub and is found bordering the Salton Sea and may be found within the pending lease areas, especially the northern pending lease area that borders a dry wash. This series is found in old beach soils, lake deposits, dissected alluvial fans, and rolling hills. Dominant species include allscale (*Atriplex polycarpa*) and saltbushes (*Atriplex* species) (Sawyer and Keeler-Wolf 1995). Other common species include saltgrass (*Distichlis spicata*), California ephedra (*Ephedra californica*), buckwheats (*Eriogonum* species), algodones buckwheat (*Eriogonum deserticola*), California buckwheat (*Eriogonum fasciculatum*), cheesebush (*Hymenoclea salsola*), paleleaf goldenbush (*Isocoma acradenia*), bladderpod (*Isomeris arborea*), and honey mesquite (*Prosopis glandulosa*).

Iodine Bush Scrub

Iodine bush scrub is mainly characterized by iodine bush (*Allenrolfea occidentalis*) and occurs around the margin of the Salton Sea. Other species within this community are seepweed (*Suaeda moquinii*), pickleweed (*Salicornia subterminalis*), and alkali heath (*Frankenia salina*).

Saltbush Scrub

Saltbush scrub is common within ground depressions (US Forest Service 2008). This series is a temperate, broad-leaved, evergreen shrubland with common species that includes fourwing saltbush (*Atriplex canescens*), shadscale (*Atriplex confertifolia*), big saltbush (*Atriplex lentiformis*), and allscale (*Atriplex polycarpa*) (Sawyer and Keeler-Wolf 1995).

Agricultural/Ruderal

The furthest southern pending lease areas overlap areas that were historically and intermittently used for agriculture. This is the most northern portion of an area of productive agriculture supported by an intricate system of dikes, pump stations, drains, and irrigation canals. Much of the agricultural production is alfalfa or food crops for retail sale during the winter months. The area overlapped by pending leases is dominated by agricultural weeds and volunteer and invasive species resulting from disturbance (Bureau of Reclamation 2000).

Invasive Species

Invasive species are considered by BLM to be plants that have been introduced into an environment where they did not evolve (Bureau of Land Management 1998). Invasive species can have dramatic impacts on the natural ecosystem by reducing habitat for native vegetation, as well as, altering forage and wildlife habitat. Invasive species reduce the productivity of healthy rangelands, forestlands, riparian areas, and wetlands. Eradication of these species is intensive, time consuming, and costly.

In California, it is estimated that 3 percent of plant species growing in the wild are considered invasive species. Despite this small percentage, these species occupy a much greater proportion of area (California Invasive Plant Council 2008). Known invasive species within the project area include Sahara mustard (*Brassica tournefortii*) and salt cedar (*Tamarix* species) (Bureau of Land Management 2003). Sahara mustard is highly invasive in the Colorado Desert, adapting to dry sandy soils and out-competing native species, particularly desert annuals (California Invasive Plant Council 2008). Salt cedar thrives in riparian areas and wetlands, but is also tolerant of arid ecosystems. Salt cedar out-competes native vegetation by consuming large quantities of groundwater and depositing salts, making the soil too dry and saline for native vegetation. The BLM El Centro FO has an active management plan to address salt cedar.

Wetlands/Riparian Areas

Freshwater forested scrub wetland is found in several locations in the southern half of the Frink NW quad and within the northern pending lease area (US Fish and Wildlife Service 2008). Traversing the northern pending lease area is a wetland area that is fed by springs and water from the upstream aquaculture farm. The area remains moist throughout much of the year and often contains pools of standing water. The area drains into the Salton Sea. These streams include the Arroyo Salada, Surprise Wash, Tule Wash, and the Tarantula Wash.

This area contains willows and salt cedar. Rush (*Juncus* spp.) as well as other wetland obligate species area present in the riparian and wetland area created in the wash. The area provided valuable wildlife habitat.

Special Status Species

There are several special status species that are known to occur or may potentially occur within the vicinity of the proposed action. Special status species include Federally-listed endangered, threatened, proposed, and candidate plant species, California State-listed endangered, threatened, and rare plant species, and BLM sensitive plant species. See Section 12.3.10 *Threatened, Endangered, and Special Status Species*, for discussion of these species.

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase of noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species;
- Conflicts with BLM or US Forest Service management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation or important habitats or communities; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts associated with the elimination and degradation of habitat. Geothermal development can cause the following stressors and associated impacts on vegetation and important habitats (Table 3.9-1 of Volume I the PEIS *Potential Impacts of Vegetation and Important Habitats*, provides a break down of the likelihood for impacts to occur during each phase of geothermal development):

- *Habitat disturbance* – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities would disturb habitat which would cause

mortality and injury, increased risk of invasive species, and alter water and seed dispersion, as well as wildlife use, which can further affect vegetation communities.

- *Direct Removal and Injury* – Vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. Activities could result in loss of soil, loss of seed bank in soil, deposition of dust, and destruction of biological soil crusts. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control. This would result in a net loss of important habitats and communities throughout the planning area.
- *Invasive Vegetation* – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas and threatening the continued existence of endemic species (Bureau of Land Management 2007).
- *Fire* – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and smoking can all result in accidental fires. Fires destroy vegetation and can aid in the establishment of invasive species.
- *Erosion* – Site clearing, grading, construction of access roads, containment basins, site runoff and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in affects to riparian vegetation and riparian habitats).
- *Exposure to Contaminant* – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse affects on non-target vegetation.

Riparian and Wetland Habitat

The riparian swale and wetland habitats within the pending lease area may be affected by activities associated with all phases of geothermal projects. The construction of roadways, buildings, and other support structures may require the conversion of wetland areas. Additionally, the extraction of geothermal fluids and the use of water for drilling can alter groundwater and regional

hydrology, which can have direct effects on adjacent wetland and riparian areas. Chapter 4 of Volume I of the PEIS provides more specific detail on the impacts on riparian and wetland habitats associated with geothermal activities. Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the U.S. Army Corps of Engineers (Corp) will be required if future development at the site will have any impact on wetlands under Corps' jurisdiction. In addition, E.O. 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. DOE implementation of this E.O. is included in 10 CFR 1022.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on vegetation in the lease areas; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative impacts on vegetation. Vegetation may be removed during exploration and drilling operations and development phases of a geothermal project along with the installation of solar energy facilities and railroad work. In areas where vegetation is removed, short-term, potential infestation of invasive weed species could occur. By complying with lease stipulations and best management practices outlined in Chapter 2 and Appendix D, respectively, cumulative impacts on vegetation would be reduced.

12.3.9 FISH AND WILDLIFE

Setting

Fisheries

There are no fish-bearing waters (including springs, seeps, or slow-moving streams) within the pending lease areas because of intermittent surface water resources resulting from the sandy, mountainous, and arid environment; however, the Salton Sea which is just over a mile from the pending lease area, contains a single native fish species, desert pupfish (*Cyprinodon macularius*) and several non-native fish species. The desert pupfish is listed as endangered under the Endangered Species Act. The introduced fish species are predominantly tilapia, Gulf croaker, orangemouth corvina, and sargo and they sustain an important sport fishery and provide the food base for fish-eating birds.

Wildlife

Animal abundance and diversity are closely linked with the habitat types present, though abundance and distribution may vary by seasons. The inhospitable habitat conditions limit the number, type, diversity, and abundance of species in the pending lease area.

Desert animals are well adapted to survive under extreme environmental conditions. Many small desert mammals are able to survive without freestanding

water. They have adapted to rely on metabolic water for a large proportion of their water needs. In addition, since most desert animals are active predominantly at night and during the day typically retreat to cool burrows, or seek shelter either under vegetation or in rock outcrops, in order to avoid the midday sun, this action also reduces water loss. A variety of reptiles and amphibians are likely to occur in the pending lease area, including the San Sebastian leopard frog (or lowland leopard frog; *Rana yavapaiensis*), Couch's spadefoot toad (*Scaphiopus couchi*), and the flat-tailed horned lizard (*Phrynosoma mcallii*). These species are well-adapted to extremely dry conditions in areas with sandy, well-drained soils often occupied by creosote bush. Canals, roadside ditches, ponds, and riparian grasses of the Salton Basin also provide habitat, such as that of the San Sebastian leopard frog (Jennings and Hayes 1994).

Extensive root systems of desert plants such as creosote bush provide access to subsurface openings for toads, salamanders, lizards, snakes, and small mammals. Small wildlife species may also create burrows in open areas to escape the heat or predators. For example, the flat-tailed horned lizard has been observed retreating to a burrow when daytime surface temperatures have approached 120°F (Bureau of Land Management 2003).

The BLM designated the flat tailed horned lizard as a sensitive species in 1980. The designation provides increased management attention to prevent population declines and habitat loss or degradation within the Salton Basin (Bureau of Land Management 2003). Local populations of this lizard fluctuate greatly between years and because of winter/spring precipitation and production of annuals in spring; as such, these populations are very susceptible to human activities (Bureau of Land Management 2003). The flat tailed horned lizard is further discussed below in Section 12.3.10 *Threatened and Endangered Species and Special Status Species*.

The entire Salton Basin, including the pending lease area, is home to a great diversity of migratory birds (California Resources Agency 2007). The Salton Sea is a vital link in the Pacific Flyway as birds migrate along this coastal corridor. More than 400 bird species have been recorded and approximately 100 of these species have established breeding populations at the Salton Sea (Patten et al. 2003). The Sonny Bono Salton Sea National Wildlife Refuge, near the town of Niland on the eastern shore of the Salton Sea supports the bird population and provides significant bird watching recreation opportunities. Migratory birds within the project area include: the Swainson's hawk (*Buteo swainsoni*), southwestern willow flycatcher (*Empidonax traillii extimus*), and California black rail (*Laterallus jamaicensis coturniculus*). The Salton Basin provides an important food source to migratory birds during migrations north or south.

The pending geothermal lease area does not incorporate the Salton Sea, but the proposed pending lease area is within 1.5 miles of the eastern shoreline.

Migratory bird would likely pass through the pending lease area and may use a small wetland found in the pending lease area for foraging.

Several mammals occur in the area. They include: desert pocket mice (*Perognathus* species), desert kangaroo rat (*Dipodomys deserti*), rabbits, ground squirrel, and mule deer (*Odocoileus hemionus*) which seek the protection of the heavier vegetation typically found in riparian areas. Mule deer rarely travel far from water or forage, and tend to bed down within easy walking distance of both. This species typically forages around dawn and dusk while bedding down in protected areas during mid-day. However, in the arid climates (such as the Salton Basin), mule deer may migrate in response to rainfall patterns. Coyotes (*Canis latrans*) are also common in the area.

Impacts

Potential impacts on Fish and Wildlife could occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels or causing a substantial loss or disturbance to habitat (such effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat);
- Have a substantial adverse impact on nesting migratory birds, including raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the migration of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; and
- Conflict with the wildlife management strategies of the BLM or US Forest Service.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts, as described below. Fish and aquatic life would be at minimal risk of being affected from geothermal development on the proposed lease sites. Impacts on fish in the Salton Sea may result if hazardous materials or geothermal fluid were to be released into the watershed in quantities that would be detrimental to the species.

Terrestrial wildlife species could be displaced during the removal of habitat or development of geothermal facilities. Small ground dwelling species such as reptiles and small mammals could also be crushed by vehicular traffic and clearing activities. Fire can also cause direct mortality. Vehicles, cigarette smoking, and power lines can cause wildfires that can kill and displace animal species, especially smaller and less mobile animals. Invasive vegetation introduced during exploration and development activities can also alter wildlife habitat, making it less suitable for habitation.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on wildlife in the lease areas; however, anticipated future actions associated with development of geothermal resources could indirectly contribute to cumulative wildlife impacts. Construction activities, such as grading, digging, and the use of heavy vehicles, could result in temporarily disturbing wildlife under the Proposed Action and other cumulative actions. Habitat would also be lost under the Proposed Action and the potential solar energy projects.

12.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats that may occur in the pending lease area. Species not expected to occur in the area are only listed in the table below, but are not discussed further.

Special status species are those identified by federal or state agencies as needing additional management considerations or protection. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the Endangered Species Act. State sensitive species are those considered sensitive by the California Department of Fish and Game. A list of Sensitive species that may occur in the pending lease area is provided below based on a search of the California Natural Diversity Database, other documents as referenced, and understanding of the local habitat. Table 12.3-1 below lists species known to occur in the greater project area and their potential to occur in the pending lease areas. There are no designated critical habitats on public land in the project area, but there is potential for the presence of desert tortoise, a threatened and endangered species.

Abrams' Spurge (*Chamaesyce abramsiana*) is known to occur in the scrublands of the Sonora and Mojave desert on sandy flats, between the elevations of 15 and 3000 feet above mean sea level. The pending lease area is below mean sea level and the presence of the species is low.

**Table I2.3-1
Species Known to Occur in the Pending Lease Area**

Scientific Name	Common Name	Status Federal ¹ /State ² / California Native Plant Society ³	Potential Occurence ⁴
PLANTS			
<i>Chamaesyce abramsiana</i>	Abrams' spurge	--/--/IB.3	Low
<i>Salvia greatae</i>	Orocopia sage	--/--/IB.3/	Moderate
FISH			
<i>Xyrauchen texanus</i>	razorback sucker	FE/SE	None
<i>Cyprinodon macularius</i>	desert pupfish	FE/SE	None
REPTILES and AMPHIBIANS			
<i>Gopherus agassizii</i>	Desert tortoise	FT/ST	Low
<i>Bufo alvarius</i>	Colorado River toad	--/SC	None
<i>Rana yavapaiensis</i>	lowland (=Yavapai, San Sebastian & San Felipe) leopard frog	--/SC	None
<i>Phrynosoma mcallii</i>	flat-tailed horned lizard	--/SC	High
BIRDS			
<i>Rallus longirostris yumanensis</i>	Yuma clapper rail	FE/ST	Moderate
<i>Empidonax traillii extimus</i>	Southwestern Willow flycatcher	FE/SE	Moderate
<i>Dendroica petechia brewsteri</i>	yellow warbler	--/SC	Low
<i>Icteria virens</i>	yellow-breasted chat	--/SC	Low

Source: California Natural Diversity Database 2008, Bureau of Land Management 2003

¹Federal status:

FE = Endangered under the Endangered Species Act

²California state status

SE = State Endangered; critically imperiled due to extreme rarity, imminent threats, and or biological factors

ST = State Threatened; Imperiled due to rarity and/or other demonstrable factors

SC = State species of concern; apparently secure, though frequently quite rare in parts of its range, especially at its periphery

³California Native Plant Society

IB.3 = Rare throughout its range, no current threats known to the species

⁴Potential to Occur

None = No suitable habitat exists and no records of its occurrence in the area are known.

Low = Suitable habitat is not presented, but rare occurrence may result during migration or other transient activities.

Moderate = Suitable habitat is present, but no records of its occurrence in the area are known, or suitable habitat is no longer present, however, records indicate the species has been known to occur in the area.

High = Suitable habitat exists and the species is known to occur in the area.

Orocopia sage (*Salvia greatae*) is listed by California Native Plant Society as a rare species in California (California Native Plant Society Status 1B.3). Historically, this perennial evergreen shrub occurs in Mojavean and Sonoran desert scrubs, between elevations of -100 to 2,700 feet above mean sea level. The Orocopia sage has a moderate potential of occurring in the pending lease area.

Flat-tailed horned lizard (*Phrynosoma mcallii*) is a California species of special concern, found throughout most of the Colorado Desert, from northern Coachella Valley to northeastern Baja California, Mexico. In California, the flat-tailed horned lizard was designated a sensitive species by the BLM in 1980.

In 1994, several Federal agencies, including the BLM and USFWS, signed a Memorandum of Understanding (MOU), a conservation agreement establishing a general framework for protecting the flat-tailed horned lizard. In 2003, the BLM signed the *Flat-tailed Horned Lizard Management Strategy*.

The flat-tailed horned lizard occupies areas with fine, wind-blown sand deposits, and has been recorded in several vegetative communities where this substrate occurs, such as creosote bush (*Larrea tridentata*), burro weed (*Franseria dumosa*), bur-sage, and indigo-bush (*Psorothamnus* species). The presence of flat-tailed horned lizards has been recorded within the proposed action area and throughout the surrounding area. The flat-tailed horned lizard has a high potential of occurring in the pending lease area; however, the lease sites are not within the designated flat-tailed horned lizard management area.

Southwestern willow flycatcher (*Empidonax traillii extimus*), yellow warbler (*Dendroica petechia brewsteri*) and yellow-breasted chat (*Icteria virens*) can be found in riparian habitats, open woodlands, and orchards; however, breeding is restricted to riparian woodlands. Southwestern willow flycatcher has potential to occur in the willows found in the riparian areas within and near the lease areas. The yellow warbler is a fairly common spring migrant, uncommon and localized summer resident, fairly common fall migrant and a rare winter visitor.

Impacts

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violation the Endangered Species Act, Migratory Bird Treaty Act, or applicable state laws; or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)

The No Action alternative would have no impact on threatened and endangered species and special status species because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on threatened and endangered and special status species; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Threatened and endangered species (including federal and state listed species and BLM special status species) could be affected as a result of 1) habitat disturbance, 2) the introduction of invasive vegetation, 3) injury or mortality, 4) erosion and runoff, 5) fugitive dust, 6) noise, 7) exposure to contaminants, and 8) interference with behavioral activities. Species most likely to be affected are the flat-tailed horned lizard and Orocopia sage.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, and the requirements specified in BLM Manual 6840 Special Status Species Management and other resource-specific regulations and guidelines, appropriate survey, avoidance, and mitigation measures would be identified and implemented prior to any geothermal activities to avoid adversely affecting any sensitive species or the habitats on which they rely.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on special status species in the region; however, anticipated future actions following leasing could contribute to cumulative special status species impacts. Loss of habitat from all aspects of development is a major factor contributing to the increase in the number of species listed as threatened or endangered. Future development in the lease areas is likely; however, development would be limited to small areas and disturbance would be temporary. Cumulative impacts are not likely to adversely affect special status species in the lease area.

Roads contribute to the cumulative impacts within a region. Existing roads would be used where possible for future development; however, improvements to existing roads and construction of new roads would likely be needed. Increased usage of surrounding roads and new road construction could impact populations of flat-tailed horned lizards. They are susceptible to mortality on roadways and in development areas. Additional road construction would reduce available habitat and may crush lizards and their burrows. Habitat for the lizard is not abundant in the lease area and surrounding area. Cumulative impacts are not likely to adversely affect this species.

12.3.11 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in the PEIS, discussions relevant to cultural resources in this document are found in two sections. Traditional cultural resources and traditional cultural properties are addressed in Section 12.3.12, *Tribal Interests and Traditional Cultural Resources*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

Both leases in the El Centro group of leases are within the California culture region, as described in Appendix I of Volume III of the PEIS. Bean (1978) and Luomala (1978) provide an ethnographic overview of the project area within the larger California culture region. The following discussion is based primarily on those overviews and a Class I survey done in the Salton Sea area (Tetra Tech 2002). The leases are considered to be within the traditional territory of Cahuilla and Yuman-speaking groups, including the Tipai. Traditional Cahuilla territory encompassed the northern half of the Salton Sink and includes the San Jacinto, Santa Rosa, and Orocopa Mountains, the southwestern slope of the San Bernardino Mountains, and the northeastern foothills of the Palomar Mountains (Bureau of Land Management 2007; Bean 1978). The traditional territory of the Yuman-speaking groups occupied the southern half of the Salton Sink, east to the Pacific Coast, west to the western slopes of the Sand Hills, and south into modern-day Baja California and Mexico (Luomala 1978). Both groups likely occupied the specific El Centro lease areas at different times prehistorically.

The Salton Sea was formed over a two-year period from 1905 to 1907 when the Colorado River breached the dike of a man-made irrigation canal and flowed into the Imperial Valley. The Salton Sea lies within the Salton Sink, which is a topographic depression that had been filled with waters from the Colorado River several times throughout prehistory as the river had repeatedly changed its course. The ancient lake is referred to as Lake Cahuilla, and was several times larger than the existing Salton Sea. Lake Cahuilla had an area of approximately 2,100 square miles, extending 110 miles in length and approximately 34 miles in width (Tetra Tech 2002).

The traditional Cahuilla territory was situated in a favorable location for trade, being bisected by the Cocopa-Maricopa trade route and adjacent to the Santa Fe and Yuman routes. This allowed the Cahuilla to be extensively involved in

trade and intermarriage between groups. Villages were usually sited in canyons or on alluvial fans near freshwater sources and subsistence resources. A trail system for hunting, gathering, and trade connected the villages. Each village was marked by petroglyphs and pictographs in the surrounding area. Occupation of villages was more or less permanent. Some individuals moved to acorn groves for several weeks during the acorn-collecting season. Large granaries were used for storage of acorns and other large quantities of food. Although hunting and gathering provided the basis of subsistence for the Cahuilla, they did practice proto-agricultural techniques growing corn, beans, squashes, and melons (Bean 1990).

Yuman groups such as the Tipai were autonomous semi-nomadic bands of clans that lived in campsites and most commonly traded with neighboring Ipais; however, like the Cahuilla, intertribal trade routes were also within the territory. Locations of campsites were selected for access to freshwater, drainage, natural protection from wind and attacks, and abundance of subsistence resources. Summer camps consisted of windbreaks or trees, particularly in Mountain oak groves. Caves fronted with rocks were also used during the summer. During the winter well-sheltered areas at low elevations were occupied and clusters of dwellings were constructed. Winter sites were located to take advantage of the surrounding landscape, typically in a sheltered foothill or valley. Winter houses were semi-excavated and constructed of a dome or gable set on the ground. Movement of the bands was seasonal following ripening plants from canyon floor to higher mountain slopes (Luomala 1990).

The majority of the lease areas are contained below the elevation contour that generally defines the shoreline of ancient Lake Cahuilla. The shoreline crosses through some of the lease areas, and portions of the lease areas exist above the shoreline. The elevation contour defining the shoreline lies at approximately 40 feet above mean sea level; however, Lake Cahuilla varied in its surface elevation throughout history. Four possible high levels of the lake were determined to exist approximately between 100 B.C. and 1530 A.D. These intermittent freshwater lake and lagoon habitats were rich sources of many resources that attracted prehistoric populations. Archaeological surveys along the western shore, opposite the lease areas, have revealed many lake-related prehistoric archaeological resources, including rock fish weirs, shell middens, fish remains, and other cultural artifacts. The archaeological resources along the eastern shoreline of the ancient lake are less studied. Obsidian Butte on the southeastern shore is an important regional quarry for prehistoric tools. Fish weirs are not common, probably due to topography (Tetra Tech 2002). Given the high density of resources along the western shore, undiscovered prehistoric cultural resources can be expected to also be present along the eastern shoreline.

Historic contact between the European populations and the Cahuilla and Tipai were initially minimal, with the exception of those baptized at local missions. As

contact between the Cahuilla and Spanish increased, the Cahuilla began to adopt Spanish characteristics such as cattle grazing, wage labor, clothing, language, and religion. Some would work seasonally for the Spanish and then return to their villages; however, the Cahuilla maintained a significant amount of their autonomy throughout Spanish occupation of the area (Bean 1990). Conversely, Tipais were considered resistant to Spanish control possibly due to the sedentary lifestyle it represented. Following occupation of California by the US, settlers began to seize Tipai lands. Although reservations were established in southern California, most Tipai considered them inadequate for their economy (Luomala 1990).

Historic use of the eastern Salton Sea shore includes transportation, mineral extraction, and agriculture. Early trails and a stage route were replaced by the Southern Pacific Railroad in the 1870s. The original tracks were inundated when the sea was formed, as was a large commercial salt mine begun in 1884. Niland, to the south of the lease areas, was promoted as an agricultural center but also became an important shipping point on the rail line, which was rebuilt on higher ground. Salt mining was reestablished west of Niland in 1919 at Mullet Island and a sand and gravel mine was established in 1926. Geothermal exploration and development attempts in the vicinity of the Salton Buttes date to the late 1920s; the first commercial well came online 1964. From 1932 until the mid-1950s, wells tapping CO₂ associated with the geothermal resource were used to produce dry ice (Tetra Tech 2002).

Data on cultural resources of the proposed lease area were gathered from the Southeast Information Center (SEIC) of the California Historic Resources Information System in April 2008 (SEIC File No. 0687). The SEIC noted that the lease areas are on the recessional shoreline of Lake Cahuilla. Portions of the west bank have been listed on the National Register of Historic Places (NRHP) and sites on the east bank of the pluvial lake, where the leases areas are, tend to have very small lithic tools. Very little (less than 10-percent) of the lease areas have been previously surveyed. Most of those conducted within a one-half mile radius of the leases were conducted prior to 1990. Fifteen cultural resources have been recorded within one-half mile of CACA 046142 and 21 within one-half mile of CACA 043965.

The majority of sites in the area of CACA 043965 are prehistoric sites on the shoreline of Lake Cahuilla. Two of the sites are historic linear resources associated with water delivery systems. Additionally, one of the sites is a Native American trail. Three of the sites within one-half mile of CACA 043965, CA-IMP-7835 (P-13-8333), CA-IMP-6889, and CA-IMP-6507, are within the proposed lease areas. CA-IMP-6507 is a prehistoric site consisting of “five [cleared] circles with associated lithics and ceramics and traces of midden” (von Werlhof 1991). When re-recorded in 1991, the site was described as in good condition. CA-IMP-6889 is an isolated prehistoric lithic artifact. CA-IMP-7835H is the in-use East Highline Canal, originally constructed prior to 1914. As part of the All American Canal System (CA-IMP-7130H) the canal is eligible for the

NRHP. Four previous linear surveys, 003, 0476, 03287 and 0438, have been conducted within the lease area and together cover less than 10-percent of the lease area.

Sites in the area of Lease CACA 046142 are mostly prehistoric sites on past shorelines of Lake Cahuilla. Notably, one of the prehistoric resources is a series of house pits and associated domestic refuse along the 20-foot above mean sea level terrace. It is noted that the pits are similar to those on the west shore of Lake Cahuilla. Two of the sites within one-half mile are historic linear resources associated with water delivery systems and the Southern Pacific Railroad. Four sites, CA-IMP-802, CA-IMP-1499, CA-IMP-3209H, and CA-IMP-3424H, are within the area of CACA 046142. CA-IMP-802 and CA-IMP-1499 are described as prehistoric lithic scatters with pottery locii. CA-IMP-3209H is a historic location of freshwater and grass noted on the 1856 US General Land Office map of the area by H.S. Washburn. CA-IMP-3424H is the historic route, including bridges, of the Southern Pacific Railroad (now Union Pacific Railroad), constructed in the 1870s, as noted on the 1895 US General Land Office map by F.S. Ingalls. It has been upgraded several times since its original construction, but is still eligible for the NRHP. Four previous linear surveys, 01042, 01043, 0438, and 03287, and a portion of one block survey, 0969, have been conducted within the lease area and together cover less than 10-percent of the lease.

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess historic properties that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication, however consultation is considered on-going.

It is unknown if the BLM holds additional survey reports or documentation of other recorded sites within the public lands of the lease areas. It appears several of the sites identified through the SEIC records search have not been evaluated for the NRHP. Additionally, until consultation with local Native Americans has been completed, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease areas. The presence of cultural resources within portions of the leases not previously surveyed is also possible. Table 12.3-2 summarizes available data on the cultural resources of the proposed lease areas.

Table 12.3-2
Recorded Cultural Resources in the Proposed Lease Areas

Lease CACA	Survey Coverage	NRHP- listed sites	NRHP- eligible sites	NRHP- ineligible sites	Unevaluated sites (Treated as NRHP- eligible)
043965	<10%	N/A	1	N/A	2
046142	<10%	N/A	1	N/A	3

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act for geothermal leasing on public lands in California is conducted in adherence to the State Protocol amendment for Geothermal leasing, which requires BLM consultation with the State Historic Preservation Office only when BLM proposes to complete less than a Class III survey of the affected (selected) lands and when informal consultation with State Historic Preservation Office staff yields consensus agreement to proceed with formal consultation by allowing for a Class I record search and Tribal consultation to be considered adequate inventory and identification methodology for the purposes of Fluid Minerals decisions at the leasing stage. The agreement requires a Class III survey of all leased lands when surface occupancy is requested. The Class I record search and tribal consultation at the time of leasing are proposed to identify any potential adverse effects on historic properties which should be considered during the earliest phases of planning.

Given the sensitivity of Lake Cahuilla shorelines, the density of unevaluated and NRHP-eligible resources, and lack of previous survey coverage within the El Centro area leases, impacts on cultural resources could occur from subsequent permitted geothermal exploration, drilling operations and development, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and -eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to

the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on cultural resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the projects identified in Section 12.1.6, *Cumulative Projects*, undoubtedly have had and will have effects on cultural resources given the area's density of cultural resources and general lack of survey coverage. Presumably past activities would have mitigated impacts to less than significant through re-design, data recovery, or other similar methods. Any indirect effects from anticipated future actions following leasing under the Proposed Action would be mitigated to less than significant through implementation of best management practices during the permitting process.

12.3.12 TRIBAL INTERESTS AND TRADITIONAL CULTURAL RESOURCES

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The subject lease areas are contained within the Great Basin culture region, as described broadly in the Appendix I of the PEIS.

The Lake Cahuilla area was utilized at least seasonally by many groups in Southern California, Northern Baja California and the Colorado River drainage along the border with Arizona. At contact, the area appears to have been a crossroad with tribal groups related linguistically with Takic and Numic in the north and those related linguistically with Yuman groups to the south. The decedents of many of these groups have been absorbed into contemporary communities and reservations outside of the lease areas. Tribal affiliations include the Cocopah, Chemehuevi, Mohave, Tipai, Ipai, Kumeyaay, Luiseno, Cahuilla, Cupeño, Serrano, Quechan and Desert Cahuilla (Tetra Tech 2002).

The closest existing reservation to the project area is that of the Torrez-Martinez tribe, located on the northwest shore of the Salton Sea. The Cahuillas and their neighboring tribes to the west claim treaty rights to a very large bloc

of land in Imperial, San Diego, and Riverside Counties. The Federal government subsequently allocated only portions of that land to the tribes in the form of alternating square mile parcels, which explains the checkerboard pattern of today's Torrez-Martinez Indian Reservation. The flooding of the Salton Sea basin in 1905 resulted in the inundation of nearly half of the local reservation. There have been ongoing negotiations and payments to attempt to resolve the loss of the land base (Tetra Tech 2002).

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication. However, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts on tribal interests and traditional cultural resources are assessed using the criteria found in Chapter 4 of Volume I of the PEIS. Although no tribal interests or concerns have been identified by the consultation process, the process is considered on-going and such resources may be identified in the future by tribes. Impacts on Tribal Interests would be minimized or avoided by implementing best management practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act for geothermal leasing on public lands in California is conducted in adherence to the State Protocol amendment for Geothermal leasing, which requires BLM consultation with the State Historic Preservation Office only when BLM proposes to complete less than a Class III survey of the affected (selected) lands and when informal consultation with SHPO staff yields consensus agreement to proceed with formal consultation" by allowing for a Class I record search and Tribal consultation to be considered adequate inventory and identification methodology for the purposes of Fluid

Minerals decisions at the leasing stage. The agreement requires a Class III survey of all leased lands when surface occupancy is requested. The Class I record search and tribal consultation at the time of leasing are proposed to identify any potential adverse effects to historic properties which should be considered during the earliest phases of planning.

No Traditional Cultural Resources have been identified by consulted tribes thus far, but consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 12.3.11, *Cultural Resources*, are often considered traditional resources by tribes.

Impacts on traditional cultural resources from anticipated future actions following leasing could occur through ground-disturbing activities, unauthorized actions, and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level and would require inventories, evaluations, and appropriate treatments, as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project-specific impacts after leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on tribal interests and traditional resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the project identified in Section 12.1.6, *Cumulative Projects*, may have had and may have effects on tribal interests and traditional resources given the regional density of cultural resources and general lack of survey coverage. Presumably past activities would have mitigated impacts to less than significant through re-design, data recovery, oral histories, or other similar methods. Any effects from the anticipated future actions following leasing would be mitigated to less than significant through implementation of best management practices during the permitting process.

12.3.13 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the pending lease areas. Described below is the method for managing scenic resources and the visual landscape of the pending lease areas.

The lease areas are part of the Colorado Desert geomorphic province. Major features of the area include the Salton trough, which includes the Salton Sea and the Imperial Valley. California State Highway 111 and Coachella Canal Road are the primary travel routes along the east side of the Salton Sea and past the lease areas.

The northern lease area is between the Chocolate Mountains and the Coachella Canal to the east and the Salton Sea to the west. Most of the natural vegetation in the northern lease areas are in the washes, ravines, and gullies that cross the area and drain toward Bombay Beach on the Salton Sea. Roads of various conditions also cross the northern lease area. Adjacent to the northern lease area are sparse agricultural lands, small communities, industrial areas, and recreation sites, such as hot springs. The gently rolling terrain flows toward the Salton Sea. With the exception of adjacent roads and small communities, there are no sources of light in the northern lease area.

The southern lease area is just north of Niland and between the Coachella Canal and the Salton Sea. Most of the natural vegetation in the southern lease area is in the few washes, ravines, and gullies that cross the area and drain toward the Salton Sea. The land is relatively barren of prominent landscape features. Adjacent to the southern lease areas are sparse agricultural lands and small communities. With the exception of adjacent small communities, there are no sources of light in the southern lease areas.

The BLM's Visual Resource Management System is a tool for inventorying and managing scenic resources, as well as analyzing potential impacts on visual resources. The scenery is managed using the Visual Resource Management system, described in the PEIS. The BLM (El Centro Field Office, California Desert District, California State Office) was unable to provide VRM class information for the pending lease sites for this analysis. Based on adjacent developed land uses, for the purposes of this analysis, it is assumed that the lease sites are within the VRM Class IV. The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to

minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

There are no scenic highways or scenic byways within several miles of the project area (National Scenic Byways Program 2008). There are no scenic vistas in Imperial County (California Department of Transportation 2008). The existing visual environment is comprised of open space, industrial, and residential for CACA 046142, and open space and agricultural for CACA 043965. CACA 046142 is visible from Highway 111, Coachella Canal Road, and small local roads such as Mineral Spa Road. CACA 043965 is visible from Coachella Canal Road, Old Niland Road/English Road, Wilkins Road, Winslow Road, and Gas Line Road. The pending lease sites lie just below the foothills of the Chocolate Mountains to the northeast, and at the eastern edge of the wide, largely flat Imperial Valley. The Salton Sea is located downslope from the pending lease areas to the west.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on visual resources because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in Section 4.17 of the PEIS. Future actions based on the reasonable development scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the Reasonably Foreseeable Development scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. These impacts would be noticeable, because they would be in areas that are relatively undeveloped and would be readily visible due to topography and lack of obstructions. Stipulations outlined in Chapter 2 and best management practices in Appendix D of the PEIS would minimize these impacts. It is assumed the stipulations would result in positioning new structures, roads, and operations in the landscape so they would remain visually subordinate to the characteristic landscape, and would result in landform alterations that blend in with the surrounding landscape character. Therefore, changes to visual resources based on the Reasonably Foreseeable Development scenario would result in impacts on visual resources that would be consistent with Visual Resource Management Class IV objectives.

No impacts on scenic highways, byways or vistas would result from geothermal development at either of the pending lease areas.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on visual resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Anticipated future actions and cumulative development projects would increase the number of highly visible structures in the area. This would substantially reduce the natural undeveloped landscape of the area. As with the anticipated future actions, cumulative impacts would be noticeable because future structures would not blend with the surrounding natural landscape. Sensitive receptors in the area (mobile home owners, hikers, off-highway vehicle users, etc.) could be negatively affected.

12.3.14 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The leasing area covers approximately 3,322 acres within Imperial County. Imperial County was selected as the ROI for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for Imperial County is provided based on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000, 2008).

Population

In 2006, population in Imperial County was estimated at 160,301 (US Census Bureau 2008). This is a 12.6 percent population change from 2000, when the total population within the county was 142,361. Between 1990 and 2000 population increased by approximately 23 percent. Current trends of population growth are expected to continue in the County (US Census Bureau 1990, 2000, 2008).

Housing

In 2000, there were 43,891 total housing units, 39,384 of which were occupied and 22,975 were owner occupied, with a homeowner occupancy rate of 1.4 percent and a rental property vacancy rate of 4.9 percent. In 1990, there were 36,559 total housing units, of which 32,842 units were occupied and 18,907 were owner occupied for a homeowner occupancy rate of 1.6 percent and a rental property vacancy rate of 5.0 percent (US Census Bureau 1990, 2000).

Employment

In 2000 the workforce consisted of 50,788, of which 6,375 people or 6.2 percent were unemployed. This is a decrease in unemployment from 1990,

when the workforce consisted of 43,046 people of which 14.3 percent were unemployed. Median income was \$36,024 in 2000 and \$22,442 in 1990.

Based on 2000 data, the industries employing the greatest percent of the population include educational, health and social services (22 percent); retail trade (12.3 percent); agriculture (11.7 percent); and public administration (11 percent) (US Census Bureau 1990, 2000, 2008).

Schools and Public Infrastructure

In 1990, 27,796 students were enrolled in K-12 education in Imperial County. In 2000 this number increased to 36,443 students. School enrollment is likely to follow general population changes (US Census Bureau 1990, 2000, 2008).

Environmental Justice

In the most recent census data, 72.2 percent of the population in the county identified themselves as Hispanic or Latino. Caucasians of non-Hispanic decent comprised 20.2 percent of the population (US Census Bureau 2000); the percent of minorities in the county has increased in recent years while the percent of non-Hispanic Caucasians has decreased (US Census Bureau 1990, 2000). See Table 12.3-3 below for additional details of race and ethnicity of the population for Imperial County.

**Table 12.3-3
Population by Race/Ethnicity in Imperial County**

	1990	2000	Percent Change (%)
Total Population	109,303	142,361	+ 30 %
White	73,615	70,290	- 4.5 %
Black/African American	2,622	5,624	+ 114 %
American Indian/Alaskan Native	1,859	2,666	+ 43 %
Asian	2,135	2,836	+ 32.8 %
Pacific Islander*	N/A	119	N/A
Other	29,072	55,634	+ 91.4 %
Two or more*	N/A	5,192	N/A
Hispanic or Latino**	71,935	102,817	+ 42.9 %

Source: US Census Bureau 1990, 2000.

* Not reported on 1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.

** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

In 1999, 29,681 people, or 22.6 percent of the population were living below the poverty level in Imperial County. In 1990, approximately 25,517 individuals or 23.7 percent of the population were living below poverty level. Imperial County has a higher proportion of residents classified as low income than the state

average; in 2000, approximately 14.2 percent of the population of California was classified as low income (US Census Bureau 1990, 2000, 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing socioeconomics or environmental justice.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on socioeconomics or environmental justice; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts from anticipated future actions include a potential increase in jobs and decrease in unemployment in the Imperial County due to construction and operations and maintenance jobs at newly developed geothermal plants. Geothermal development would also be a positive stimulus to the local economy through increased tax revenues at the county and state levels.

Based on the Reasonably Foreseeable Development scenario, development of two plants of 50 megawatts each is likely in the project area. The impacts for a standard 50-megawatt plant during each stage of geothermal development are discussed in Section 4.18 of the PEIS, *Socioeconomics and Environmental Justice*.

Due to the availability of unemployed workers in the county, a large population influx is not anticipated; therefore, impacts on schools and public infrastructure would be minimal. Impacts on the Hispanic and Latino population or low-income individuals are possible as these groups have a significant presence in the county. Impacts on these groups are likely to be minimal due to the lack of residential communities immediately adjacent to the pending lease sites.

Cumulative Impacts

The overall economic effect of any future geothermal development and operation at the pending lease sites would be a minor positive stimulus to the economy of the local area. In combination with other future planned development, potential cumulative effects would be minor.

I2.3.15 NOISE

Setting

Current sources of noise in the pending lease areas are limited to wind, dispersed recreational use, and wildlife. Sources of noise originating outside of the pending lease areas but affecting the pending lease areas include traffic from adjacent roads, air traffic, and activity from adjacent residences and industrial facilities.

Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. Sensitive receptors within half of a mile of CACA 046142 include:

- Residences within and nearby at the mobile home park, just east of Section 12;
- Residences north of Section 12 and east of Section 2 along Sandstone Terrace;
- Residences west of Section 12 along an unnamed east-west aligned road that connects to Hot Mineral Spa Road; and
- A residence west of Section 12 along Hot Mineral Spa Road.

Sensitive receptors within half of a mile of CACA 043965 include:

- Residences southwest of the intersection of Wilkins Road and Old Niland Road/English Road, southwest of Section 8; and
- A residence west off of Wilkins Road, west of Section 28.

Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the project area. Wildlife in the project area is discussed in Sections 12.3.9 *Fish and Wildlife*, and 12.3.10 *Threatened and Endangered Species and Special Status Species*.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on noise; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. No sensitive receptors have been identified within the pending lease areas. Adjacent and nearby sensitive receptors would be protected from noise impacts since any projects approved by the BLM would be required to adhere to the BLM regulations, requiring that noise from a major geothermal operation shall not exceed 65 A-weighted decibels at the lease boundary. Impacts on wildlife from noise sources are discussed in Sections 12.3.9, *Fish and Wildlife*, and 12.3.10 *Threatened and Endangered Species and Special Status Species*.

Cumulative Impacts

Any future cumulative construction or operation activity that causes noise disturbance would adhere to local, state, and federal regulations; therefore no cumulative noise impacts are expected.

This Page Intentionally Left Blank

SECTION 12.4

REFERENCES

Bean, Lowell John. 1990. "Cahuilla." In *Handbook of North American Indians*, Volume 8 – California. Robert F. Heizer, Volume Editor. William C. Sturtevant, General Editor. Smithsonian Institution, Washington, D.C.

Bean, Lowell John. 1990. "Cahuilla." In *Handbook of North American Indians*, Volume 8 – California. Robert F. Heizer, Volume Editor. William C. Sturtevant, General Editor. Smithsonian Institution, Washington, D.C.

Bureau of Land Management. 2007. Eastern San Diego County Proposed Resource Management Plan and Final Environmental Impact Statement.

Bureau of Land Management. 2003. Final Environmental Impact Statement for the Imperial Sand Dunes Recreation Area Management Plan and Proposed Amendment to the California Desert Conservation Plan 1980.

Bureau of Land Management. 1999. California Desert Conservation Area Plan. California Desert Region. 1980 as amended.

Bureau of Reclamation. 2000. Salton Sea Restoration Draft EIS/EIR. January 2000.

California Department of Transportation. 2008. Vista Points in California. Website: <http://www.dot.ca.gov/hq/tsip/gis/datalibrary/graphics/vista.jpg>. Accessed March 13, 2008.

California Department of Water Resources. 2003. California's Groundwater, Bulletin 118, Update 2003.

California Division of Mines and Geology. 1966. Minerals of California – Centennial Volume (1866-1966). Bulletin 189.

California Invasive Plant Council. 2008. Website: www.cal-ipc.org. Accessed April 2008.

California Natural Diversity Database. Quick Viewer. Website: http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp. Accessed April 19th, 2008.

California Resources Agency 2007. Salton Sea Ecosystem Restoration Program: Final Programmatic Environmental Impact Report.

City of El Centro. 2004. City of El Centro General Plan, Final.

Colorado River Regional Water Quality Control Board. 2006. Water Quality Control Plan. Colorado River Basin - Region 7. Includes Amendments Adopted by the Regional Board through June 2006.

Colorado River Regional Water Quality Control Board. 1986. Colorado River Basin Region (7) Map.

Division of Oil, Gas, and Geothermal Resources. 2005. Current Geothermal Operators as of October 27, 2005.

Bureau of Land Management. 2003 Final Environmental Impact Statement for the Imperial Sand Dunes Recreation Area Management Plan and Proposed Amendment to the California Desert Conservation Plan 1980. May.

Eargle, D.H. 2002. California Indian Country – The Land and the People. Tree Company Press, San Francisco.

IID Energy. 2008. Imperial Irrigation District Energy. Website: <http://www.iid.com/> Accessed March 6, 2008.

IID Energy. 2006. Integrated Resources Plan, Imperial Irrigation District Energy Department.

Imperial County. 2003. Imperial County General Plan.

Jennings, M.R., and M.P. Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. California Department of Fish and Wildlife.

Luomala, Katharine. 1990. "Tipai-Ipai." In *Handbook of North American Indians*, Volume 8 – California. Robert F. Heizer, Volume Editor. William C. Sturtevant, General Editor. Smithsonian Institution, Washington, D.C.

National Scenic Byways Program. 2008. Website: <http://www.byways.org/> Accessed March 13, 2008.

- Natural Resources Conservation Service 2003. Niland Series. Website: <http://www2.ftw.nrcs.usda.gov/osd/dat/N/NILAND.html>. Accessed March 7, 2008.
- Oregon Institute of Technology. 2008. Geo-Heat Center. Website: geoheat.oit.edu/ Accessed March 14, 2008.
- Patten, M.A. G. McCaskie, and Unitt. 2003. Birds of the Salton Sea: Status, Biogeography, and Ecology. University of California Press. Berkley, California.P.
- Sawyer, J.O., and T. Keeler-Wolf. 1995. A Manual of California Vegetation. Sacramento, CA. California Native Plant Society.
- Tetra Tech Inc. 2002. Class I Cultural Resource Inventory of the Salton Sea Region. Prepared for the Salton Sea Authority and the USDI Bureau of Reclamation, Lower Colorado Region.
- US Census Bureau. 2008. State and County QuickFacts. Website: <http://quickfacts.census.gov/qfd/states/06/06025.html>. Accessed April, 2008. Last Revised: Wednesday, 02-Jan-2008.
- US Census Bureau 2000. Census 2000 Summary Files 1, 3. Geographic Area: Imperial County, California. Website: <http://quickfacts.census.gov/qfd/states/06/060251k.html>. Accessed April 2008.
- US Census Bureau 1990. Census 1990 Summary Files 1, 3. Geographic Area: Imperial County, California. Website: <http://quickfacts.census.gov/qfd/states/06/060251k.html>. Accessed April 2008.
- US Fish and Wildlife Service. 2008. Wetlands Digital Data and Mapping. Website: wetlandsfws.er.usgs.gov. Accessed April 2008.
- US Forest Service 2008. Ecoregions of California. Website: www.fs.fed.us/r5/projects/ecoregions/ca_sections.htm. Accessed April 2008.
- US Marine Shrimp Farming Program. 2008. U.S. Shrimp Farm Locations. Website: <http://www.usmsfp.org/farm-websites/california.htm>. Accessed March 14, 2008.
- Western Regional Climate Center. 2007. Monthly Climate Summary for Brawley, California from 12/1/1927 to 4/30/2007. Website: <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1048>. Accessed April 2008.

This Page Intentionally Left Blank